PATENT SPECIFICATION 1,125,206

DRAWINGS ATTACHED.

1,125,206

Date of Application and filing Complete Specification:
5 June, 1967. No. 25833/67.

Application made in Germany (No. V31186 XII/47a) on
4 June, 1966.

Application made in Germany (No. V32835 II/63c) on
24 Jan., 1967.

Complete Specification Published: 28 Aug., 1968.

Index at Acceptance:—B7 HX7; F2 E1G1.

Int. Cl.:—B 62 d 1/18.

COMPLETE SPECIFICATION.

A Collapsible Safety Steering Column Assembly for Automotive Vehicles.

We, VOLKSWAGENWERK AKTIENGESELLSCHAFT, of 3180 Wolfsburg, Germany; a German body corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention concerns a collapsible safety steering column assembly for automotive vehicles.

In serious automotive vehicle accidents (impact accidents) the steering column assembly may be pushed into the passenger compartment due to the deformation of the front bodywork and chassis sections and lead to serious injuries to the driver.

A number of measures have already been proposed to minimize the danger to the driver by a steering column impact. One known construction from which the device of the present invention has evolved is based on the concept of forming the steering column flexible in an axial direction so that, when it is subject to impact stress, it is caused to collapse. For this purpose one section of the steering column is provided with a perforated lattice-like tube having a plurality of constrictions.

According to the present invention a collapsible safety steering colmun assembly for automative vehicles comprises an element incorporated directly in the steering column shaft adapted to absorb energy, the element having a plurality of pairs of metal strips each helically wound about the steering column axis and each pair being offset relative to the one or more other pairs, said strips interengaging and being interconnected at their intersections, the members of each pair of strips having identical pitch but opposite pitch direction and all the strips of the same pitch direction being offset about the shaft axis relative to one another at an angle of 360/n midway between the intersections where n represents the number of pairs of strips.

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a fragmentary schematic side view of a safety steering column shaft having an intermediate section constructed in accordance with the invention;

Fig. 2 is a cross-section through an intermediate member formed of four strips;

Fig. 3 are two cross-sectional views of the strips forming the intermediate member;

Fig. 4 is a view of a perforated sheet for producing a lattice tube in accordance with the invention;

Fig. 5 is the perforated plate shown in Fig. 4 welded into a tube;

Figs. 6 and 7 are two examples of an installation having a lattice tube; and

Fig. 8 is a detail of the arrangement shown in Fig. 7.

Strips of steel plate 1 and 2 (Fig. 1) are wound helically with right hand pitch and left hand pitch which are slid in one another and, at their points of intersection, are connected together by spot-welding. The structural element contains two further strips 1*a*, 2*a*, each of which is offset through 180° about the steering column axis relative to, and is wound into, the corresponding strip 1 or 2. Per pitch there are in all eight points of intersection of the strips of varying pitch direction, two intersections each being diametrically opposite. Of the further strips 1*a* and 2*a* provided, only the ends which register with the strips 1 and 2 are indicated

in Fig. 1; their spatial arrangement can therefore be shown only by the cross-sectional view of Fig. 2, in which the arrows indicate the direction of pitch of the strips. On their upper and lower ends the strips 1 and 2 are weld connected by rings 3 and 4 which in turn are connected with ends 5 and 6 of a divided steering column shaft. The rings 3 and 4, with suitable configuration, may serve to bridge any possible difference in diameter between the steering column shaft and an intermediate member.

The strips as shown in Figure 3 may have a simple rectangular cross-section or if required, be braced by a beading.

The strips, when the shaft is subject to torsion, depending upon the direction of rotation are subjected substantially to tension or compression. The strips so subjected to compression, tend to enlarge their winding diameter, whilst the strips subjected to tension tend to reduce their winding diameter. At the intersections mutual supporting occurs, whereby a considerable resistance to relative rotation is obtained.

The tangential forces occurring at the intersections, when the constructional element is subject to torsional stress, are located in pairs on the same transverse plane and produce only moments about the longitudinal axis of the element. The steering forces are hence transmitted free of transverse force. The same result is obtained if three strips with left hand and three strips with right hand pitch are provided of equal pitch when the strips of identical pitch direction are offset through 120° relative to one another. With an axial compressive stress all the strips tend to increase their diameter and therefore resist this stressing slightly.

Fig. 4 shows a plan view of a perforated sheet serving as the starting material for a lattice tube. Rhomboidal cut-outs 10 of the sheet are radiused at the corners. A substantial saving of material may be obtained if the lattice holes are not completely punched out, but the sheet merely perforated slot-shaped and then extended according to the principle of stretch lattice manufacture.

The sheet shown in Fig. 4 is rolled into a tube 11 as shown in Fig. 5 and the longitudinal edges are butt welded with one another. Intermediate members 12 and 13, welded in position serve the connection with an actual steering column shaft 14, 14. The intermediate members 12 have a flange-like extension 15, the function of which will be explained by way of the installation example shown in Fig. 6. In this installation a transverse wall 16 of the vehicle, placed relatively far back, serves to absorb the deformation forces. The extension 15 is mounted with clearance opposite a supporting ring 17 which in turn is supported against the transverse wall 16. In the transverse wall 16 a steering column casing 18 is retained by means of a rubber bearing 19. With a frontal impact accident the steering column shaft is suddenly stressed in the direction of the arrow, the lattice tube after the flange 15 has been supported against the supporting ring 17, is telescoped whilst being plastically deformed and hence suitably absorbing the deformations. The supporting ring 17 keeps the impact forces remote from the steering column 18. Collision tests, confirmed in practice, that the lattice tube 11 telescopes satisfactorily in a longitudinal direction.

In Fig. 7 there is shown a second embodiment of a safety steering column shaft in which a relatively rigid transverse vehicle wall 29 is arranged between a steering gear 20 and a flexible disc 21. In this case a lattice tube 22, which in the first phase of the collision has been partly deformed, is adapted to absorb an additional deformation effect in the course of the so-called second collision, namely the impact of a driver against a steering wheel 23. The displaceability necessary therefore of the whole steering column assembly 23, 24, 25 in the direction of travel is obtained by mounting the steering column shaft by means of a bearing 26 and by slots 27 connected by bolts 28 with the steering column 24, which bolts, in their original position, are supported against the upper edges of the slots 27 (Fig. 8).

With the first impact forces occurring in the direction of travel the bearing 26 therefore forms a rigid abutment for the deformation of the steering column shaft. With the impact of the driver against the steering wheel 23 the steering column shaft on the other hand may be forwardly displaced forwards.

WHAT WE CLAIM IS: —

1. A collapsible safety steering column assembly for automotive vehicles comprising an element incorporated directly in the steering column shaft adapted to absorb energy, the element having a plurality of pairs of metal strips each helically wound about the steering column axis and each pair being offset relative to the one or more other pairs, said strips interengaging and being interconnected at their intersections, the members of each pair of strips having identical pitch but opposite pitch direction and all the strips of the same pitch direction being offset about the shaft axis relative to one another at an angle of 360/n midway between the intersections where n represents the number of pairs of strips.

2. An assembly as claimed in claim 1, in which individual helically wound strips are slid into one another and, at their inter-

sections, are interconnected by spot welding.

3. An assembly as claimed in claim 1 in which the element comprises a perforated sheet rolled into a tube and welded.

4. An assembly as claimed in claim 3, in which the element has rhomboidal perforations which have radiused corners.

5. A collapsible steering column assembly constructed and arranged substantially as herein described with reference to and as illustrated in any one of the figures of the accompanying drawings.

POTTS, KERR & O'BRIEN.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1968.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

1125206 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig. 1

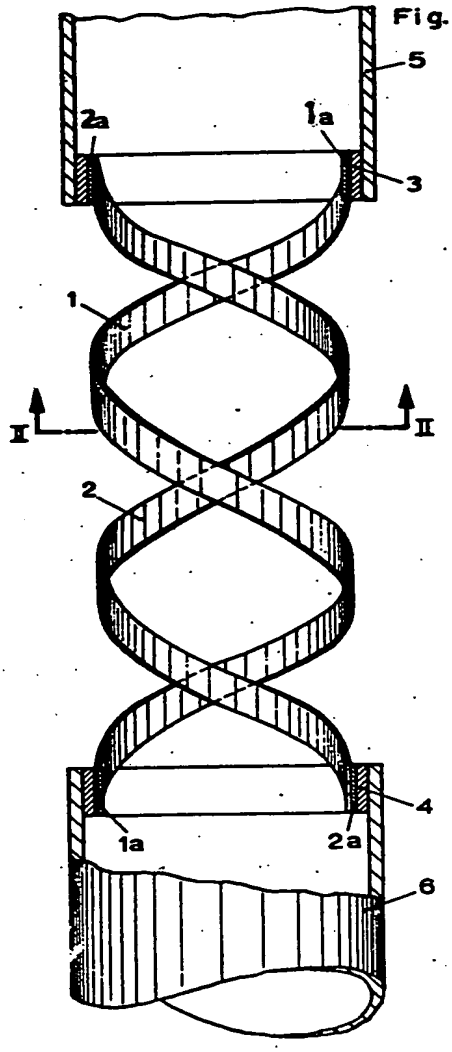

Fig. 2

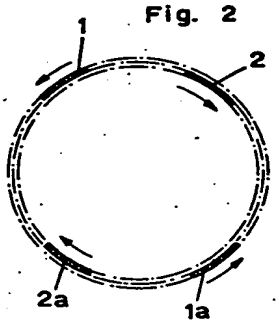

Fig. 3

1125206 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 2 & 3

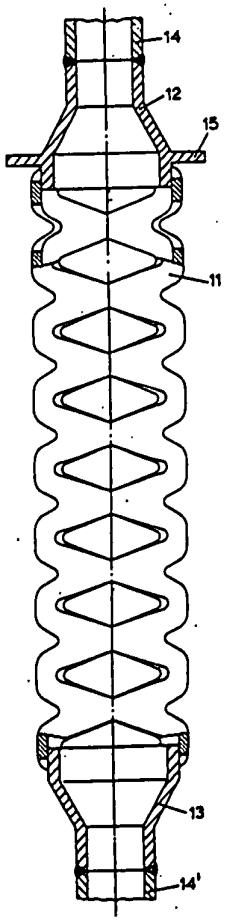

Fig. 5

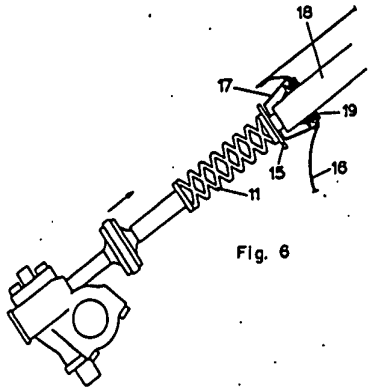

Fig. 6

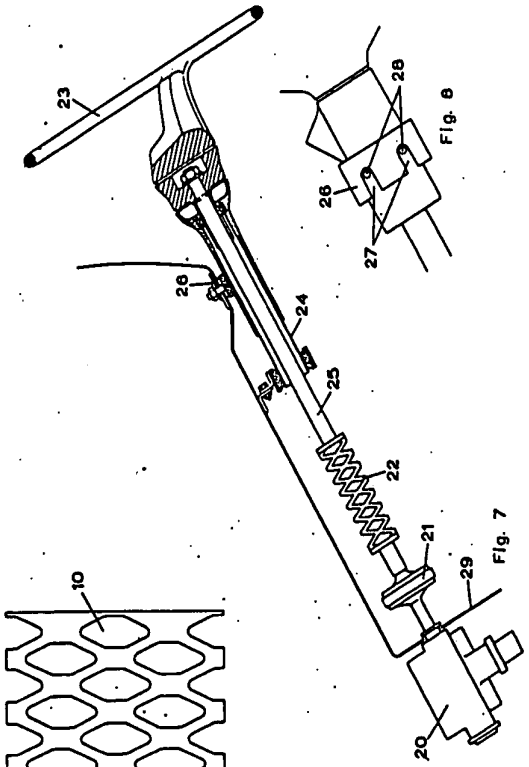

Fig. 7

Fig. 8

Fig. 4